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**United States Patent** [19]

Ohshita

[11] **Patent Number:** **5,640,277**[45] **Date of Patent:** **Jun. 17, 1997**[54] **LARGE APERTURE MEDIUM TELEPHOTO LENS SYSTEM**[75] Inventor: **Koichi Ohshita**, Tokyo, Japan[73] Assignee: **Nikon Corporation**, Tokyo, Japan[21] Appl. No.: **364,218**[22] Filed: **Dec. 27, 1994**[30] **Foreign Application Priority Data**

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[51] Int. Cl.<sup>6</sup> ..... **G02B 9/12**; G02B 15/14;  
G02B 13/02[52] U.S. Cl. .... **359/792**; 359/684; 359/746;  
359/748[58] **Field of Search** ..... 359/792, 745,  
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684, 681, 682[56] **References Cited****U.S. PATENT DOCUMENTS**

4,812,027 3/1989 Yanagisawa ..... 359/755

4,848,883 7/1989 Maruyama ..... 359/684

4,991,943 2/1991 Betensky ..... 359/684

5,172,274 12/1992 Hirakawa ..... 359/745

5,272,564 12/1993 Suzuki et al. .... 359/676

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McLeland & Naughton[57] **ABSTRACT**

The lens system includes, in order from an object side, a 1-st lens unit having a positive refractive power which has at least two positive lens elements and a negative lens element positioned on an image side of said positive lens elements, a 2-nd lens unit having a positive refractive power and a 3-rd lens unit having a positive refractive power. During focusing, both 1-st and 3-rd lens units are fixed, whereas the 2-nd lens unit is movable along an optical axis. The lens system satisfies at least one of the conditions  $1.8 < F1/f < 2.4$  and  $0.8 < F2/f < 0.96$ .

**39 Claims, 26 Drawing Sheets**